

Abstract

Acceleration of Graft Tunnel Healing in Anterior Cruciate Ligament Reconstruction using Autograft Hamstring Tendon with Transplantation Intratunnel Allogenic BM-MSCs and VEGF

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Background : Anterior cruciate ligament (ACL) injury is one of the most common knee injuries that occurs as a result of sport or physical exercise. ACL reconstruction is the gold standard of treatment for ACL injury using tendon graft. The process of tissue formation between the tendon graft and the bone is an important link at the early stage of healing process. The combination of intratunnel allogenic Bone Marrow-Mesenchymal Stem Cells (BM-MSCs) and Vascular Endothelial Growth Factor (VEGF) is able to improve the microenvironment, as well as stimulate cell proliferation, differentiation and matrix deposition by enhancing angiogenesis and osteogenesis of the graft in the tunnel.

Objective : The objective of this study is to prove the transplantation of Intratunnel Allogenic BM-MSCs and VEGF is able to enhance the early graft tunnel healing in ACL reconstruction by using autograft hamstring tendon.

Methods : A controlled animal study was promoted by using four groups of rabbits which underwent bilateral ACL reconstruction with semitendinosus tendon, then transplanted with intratunnel allogenic BM-MSCs and VEGF. The treatment was divided into two groups which based on the time of healing process evaluation, in 3 and 6 weeks. Then the graft tunnel healing was analyzed by evaluating the number of capillaries, the surface area of cells expressing ALP, collagen type I and collagen type III, the number of Sharpey like fiber, signal intensity of tendon graft, the width of tendon bone interface and pullout strength test.

Results : All parameters have indicated to increase more in the treated groups with intratunnel allogenic BM-MSCs and VEGF than the control groups without. There were significant differences of the surface area of cells in expressing ALP, collagen type I and type III, tendon graft signal intensity, and pullout strength, as well as bone tendon interface between treated and control groups. However, there were no significant differences in the number of capillaries ($p=0,275$) as well as Sharpey like fiber ($p=0,052$). The two treated groups have showed no differences in all variables studied.

Conclusion : The transplantation of intratunnel allogenic BM-MSC and VEGF after ACL reconstruction has accelerated the graft tunnel healing as early as 3 weeks after surgery.

Key words : Graft tunnel healing, Anterior cruciate ligament, Bone marrow mesenchymal stem cells, Vascular endothelial growth factor.